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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/469,709 12/21/99 LI

S 003786/PDD/C

EXAMINER

IM22/0619

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ART UNIT

PAPER NUMBER

1763

DATE MAILED:

06/19/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09-469,709

Applicant(s)

Le et al

Examiner

George Goudreau

Group Art Unit

1763

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- ☒ Responsive to communication(s) filed on 3-01' (i.e. - paper # 5)
- ☐ This action is **FINAL**.
- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 30-60 is/are pending in the application.
- Of the above claim(s) 45-58 is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 30-44, 59-60 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction or election requirement.

Application Papers

- ☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- ☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
- ☐ received.
- ☐ received in Application No. (Series Code/Serial Number) _____.
- ☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

Attachment(s)

- ☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2
- ☒ Notice of Reference(s) Cited, PTO-892
- ☐ Notice of Draftsperson's Patent Drawing Review, PTO-948
- ☐ Interview Summary, PTO-413
- ☐ Notice of Informal Patent Application, PTO-152
- ☐ Other _____

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15. Applicant's election with traverse of the method for fabricating a Cu damascene structure in Paper No. 5 is acknowledged. The traversal is on the ground(s) that the method claims as now written are not properly restrict able from the product claims based upon the examiner's previous stated reasons for restricting the two inventions on the grounds that the method claim may be practiced by hand since newly presented claim 60 recites the usage of a computer readable medium to control the cmp processes.

This is not found persuasive because of the following.

The newly presented method claims are restrict able from the newly presented product claims for the same reasons as stated in paragraph 15 of the previous office action. The examiner will restate the previous grounds for restriction over the newly presented claims in order to clarify the record.

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 30-44, 59-60, drawn to a method for cmp polishing a Cu damascene, classified in class 438, subclass 692 (+).
- II. Claims 45-58, drawn to a computer readable storage medium, classified in class 349, subclass 17 (+).

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice

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another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by hand without the specific usage of a computer readable storage medium.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventor ship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventor ship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(I).

Applicant has constructively elected for prosecution on the merits, the method claims (i.e.- claims 30-44, and 59-60). Accordingly, the apparatus claims are withdrawn from further consideration by the examiner.

As to applicant's assertion that the previous grounds for restriction of the two classes of invention are no longer appropriate based upon newly presented claim 60 which recites the usage of a computer readable storage medium in the method claims please note the following. For purposes of restriction, only the independent claims are analyzed, and not the dependent claims. Since none of the independent method claims recite the usage of a computer readable storage medium, the previous grounds for restriction are still appropriate since the independent method claims can be practice by hand without the usage of a computer readable storage medium.

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The requirement is still deemed proper and is therefore made FINAL.

16. Claims 39-40, 44, and 60 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

-The term "the chemical agent" in claims 39-40, and 44 lacks proper antecedent basis.;

and

-In claim 60 the term "remov-I" should read "removal".

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

18. Claims 30, and 59 are rejected under 35 U.S.C. 102(e) as being anticipated by

Watts et. al. (5,985,748).

Watts et. al. disclose a two step process for planarizing a Cu layer which is conformally deposited into a damascene via in an ILD layer on a wafer which is comprised of the following steps:

-A via hole is formed into an ILD layer on the surface of a wafer.;

-A TaN layer is conformally formed onto the surface of the wafer as well as inside the via hole. The TaN layer serves as a type of diffusion barrier layer.;

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-A Cu layer is deposited onto the surface of the wafer, and into a via hole on the surface of the wafer.;

-The bulk of the Cu is cmp planarized in a first machine using a first cmp slurry which removes the Cu at a rate of about 3,800 angstroms per minute, and produces dishing in the Cu of 1,600 angstroms.;

-Either the wafer or the cmp polishing pad may be rinsed prior to conducting additional processing on the wafer in order to remove abrasive debris from the cmp polishing pad.;

and

-The remaining portion of the Cu is cmp planarized in a second machine using a second cmp slurry which removes the Cu at a rate of about 1,600 angstroms per minute, and produces dishing in the Cu layer of 1,000 angstroms.

This is discussed specifically in columns 2-6; and discussed in columns 1-8. This is shown in figures 1-6.

19. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

20. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to

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the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

21. Claims 31-44, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watts et. al. as applied in paragraph 18 above.

Watts et. al. as applied in paragraph 18 above fail to disclose the following aspects of applicant's claimed invention:

- the specific rinsing of either the cmp polishing machine or each wafer after each cmp polishing step with a liquid which contains an anticorrosive agent;
- the specific cmp polishing of the TaN diffusion barrier layer on a third platen using a third cmp polishing step;
- the specific cmp polishing process parameters which are claimed by the applicant; and
- the specific recycling of the cmp slurry

It would have been desirable to cmp polishing the TaN layer on the wafer using a third cmp polishing step in a third cmp polishing machine based upon the following. The usage of a separate cmp polishing step to polish a diffusion barrier used in the formation of a Cu damascene during the planarization of the Cu layer used to fill the damascene is conventional or at least well known in the cmp polishing arts. (The examiner takes official notice in this regard.) Further, it would have been desirable to use a separate cmp polishing step in a separate cmp polishing

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machine to cmp planarize the TaN diffusion barrier layer in order to maximize the through put of the process by using different cmp polishing machines to conduct each process step rather than conducting each process step sequentially in the same polishing machine using the same polishing platen.

It would have been obvious to one skilled in the art to recycle each of the cmp slurries used in the process taught above based upon the following. The recycling of a cmp slurry used for cmp polishing a wafer is conventional or at least well known in the cmp polishing arts. (The examiner takes official notice in this regard.) Further, it would have been desirable to reduce operating costs by minimizing the amount of cmp slurry which is consumed during each process step by recycling it. Further, it would have been desirable to reduce the operating costs by minimizing the amount of spent cmp slurry which must be waste treated.

It would have been obvious to one skilled in the art to rinse either the wafer or the cmp polishing pad after each polishing step with an anticorrosive agent based upon the following. Watts et. al. teach that it is desirable to rinse either the cmp polishing pad or the wafer after the first cmp polishing step to avoid contamination of the second cmp polishing pad with abrasive debris from the first cmp polishing step. Further, the usage of rinse steps after a cmp polishing step to remove the cmp slurry from the wafer is conventional or at least well known in the cmp polishing arts. (The examiner takes official notice in this regard.) Further, it would have been desirable to rinse the wafer after each polishing step in order to prevent the undesirable cross contamination of the wafer with the different cmp slurries which are used in each step with each

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other. Further, the usage of an anticorrosive rinse step on a cmp polished wafer is conventional or at least well known in the cmp polishing arts. (The examiner takes official notice in this regard.) Further, it would have been desirable to prevent the undesirable corrosion of the Cu layer by the acids in the cmp slurry following each cmp polishing step by treating the wafer with an anticorrosive agent which will protect the Cu from further corrosion after each cmp step.

It would have been prima facie obvious to employ any of a variety of different cmp polishing process parameters in the process taught above including those which are specifically claimed by the applicant. These are all well known variables in the cmp polishing art which are known to effect both the rate and quality of the cmp polishing process. Further, the selection of particular values for these variables would not necessitate any undo experimentation which would be indicative of a showing of unexpected results.

Alternatively, it would have been obvious to one skilled in the art to employ the specific process parameters which are claimed by the applicant in conducting the cmp polishing process taught above based upon In re Aller as cited below.

"Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F. 2d 454, 105 USPQ 233, 235 (CCPA).

Further, all of the specific process parameters which are claimed by the applicant are results effective variables whose values are known to effect both the rate, and the quality of the cmp polishing process.

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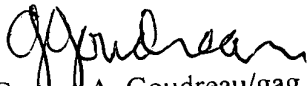
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22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner George A. Goudreau whose telephone number is (703) -308-1915. The examiner can normally be reached on Monday through Friday from 9:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Examiner Gregory Mills, can be reached on (703) -308-1633. The appropriate fax phone number for the organization where this application or proceeding is assigned is (703) -308-3599.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) -308-0661.



George A. Goudreau/gag

Examiner AU 1763